Kuivisto

Occurence type: prospect

Commodity	Rank	Total measure	Total production	Total resource	Importance
gold	1	0,26 t	NA	0,26 t	Occurrence

Easting EUREF: 712142,363
Northing EUREF: 6996344,213
Easting YKJ: 3712400
Northing YKJ: 6999275

Discovery year: 1993
Discovered by: Geological Survey of Finland
Province: Ilomantsi (Au)
District: Hattu (Au)
References: 2, 7, 13, 15

Mineral deposit type

Group: Metallogenic deposit
Main type: Orogenic (metamorphic hydrothermal)
Comments: Precipitation of gold by desulphidation of fluid and, possibly, by decomposition of Au-bisulphide, -thiosulphide and -telluride complexes of fluid due to cooling and/or changes in pH and fO2. Probably, gold precipitated just below 500°C with sulphides due to reaction between the mineralising fluid and wall-rock (chiefly by sulphidation).
References: 14

Dimension

Expression: exposed
Form: discordant
Shape: irregular
Length (m): 350
Width (m): NA
Thickness (m): NA
Depth (m): NA
Area (ha): NA
Dip azim: NA
Dip: NA
Plunge azim: NA
Plunge dip: NA
Orientation method: NA
Dimension comments: The occurrence comprises two lodes, and is open along strike and at depth. The length (300-400 m) is known only for one lode.

Holder history

Current holder: Endomines Oy
Years: 2019-2022
Holding type: Exploration permit

Previous holders:

Company	Years	Holding type	Comments
Geological Survey of Finland	-1993	NA	NA

Endomines Oy	2011-2012	Claim reservation (old law)	NA
Endomines Oy	2003-2011	Claim (old law)	NA
Endomines Oy	1993	NA	NA

EXPLORATION ACTIVITY

Endomines Oy

Years	Activity type	Geologist	Exploration result	Ref
2011-2011	detailed geophysics	Jaakko Liikanen	geophysical anomaly	
	Airborne low-altitude [VTEM] geophysical surveys were completed over the entire permit area			

2009-2009	geostatistical estimates	NA	mineral resource defined	
	Mineral resource assessment for Endomines, compliled by Maptek. The resource extends to 100 m depth and is based on "38 surface diamond drillholes and 8 surface RC drillholes. Holes were drilled at variable spacing but typically at 25m sections for the majority of the deposit."			

1996-2008	core drilling	Jaakko Liikanen	mineral resource indicated	1, 2, 6
	Intersections			
	HoleID	KU-11		
	From-To	15,3-16,2		
	Length	0,9m		
	gold	25,5ppm		

1996-1996	detailed geophysics	Jaakko Liikanen	geophysical anomaly	12, 14
	No response on magnetic or slingram methods. Magnetic and electric methods do show the structural features of the area, including those which control gold mineralisation. An IP anomaly indicates the presence of the Au-mineralised zone.			

1996-2008	geological interpretation	Jaakko Liikanen	mineral occurrences	12, 15

Geological Survey of Finland

Years	Activity type	Geologist	Exploration result	Ref
1993-1993	regional geophysics	NA	key geological features	8, 9, 14
	Low-altitude airborne magnetic, electromagnetic and radiometric survey			

1990-1995	core drilling	Timo Heino	mineral occurrences	9
	Core drilling (reconnaissance drilling): 41 diamond-drill holes, total 2997 m. Discovery by drilling into structurally favourable location within a local geochemical anomaly in till.			
	Intersections			
	HoleID	NA		
	From-To	NA		
	Length	6m		
	gold	4,3ppm		
	HoleID	NA		
	From-To	NA		
	Length	12m		
	gold	3,6ppm		
	HoleID	NA		
	From-To	NA		
	Length	3m		
	gold	7,2ppm		

	HoleID	NA
	From-To	NA
	Length	1m
	gold	43,2ppm
	HoleID	NA
	From-To	NA
	Length	2,1m
	gold	4,9ppm
	HoleID	NA
	From-To	NA
	Length	1m
	gold	35,7ppm
	HoleID	NA
	From-To	NA
	Length	2,8m
	gold	2,5ppm

1990-1995	excavation	Timo Heino	mineral occurrences	8, 9, 14

1990-1995	detailed geochemistry	Timo Heino	geochemical anomaly	14
	Till-bedrock interface geochemistry, samples collected across the Au anomaly along traverses 100 m apart with sampling distance 10-30 m			

1990-1995	detailed geophysics	Timo Heino	geophysical anomaly	12, 14
	No response on magneti or slingram methods. Magnetic and electric methods do show the structural features of the area, including those which control gold mineralisation. An IP anomaly indicates the presence of the Au-mineralised zone.			

1990-1995	detailed geology	Timo Heino	mineral occurrences	8, 9, 14

1984-1984	regional geochemistry	Aimo Hartikainen	geochemical anomaly	
	Country-wide till-geochemical survey			

1983-1989	regional geochemistry	Aimo Hartikainen	geochemical anomaly	8, 9
	Regional Au, As and B till anomaly, local Au, Te and Bi anomaly(?). Au content within the till anomaly is from tens of ppb to >1 ppm. Best combination for defining exploration targets: Au + Te + Bi - better than Au alone.			

RESOURCES AND RESERVES

Most recent

Type:	Company:	Year:	Date:	Calc Method:	Reference:
Resource	Endomines Oy	2013	31.12.2022	JORC code	3, 4, 5, 6
	Comments: Mineral resources remain the same 31.12.2022.				
	Category:	**Indicated mineral resource**			
	Tonnage:	**37000 t**			
	gold	3,2 ppm			
	Cutoff:	**gold**			
	Category:	**Inferred mineral resource**			
	Tonnage:	**145000 t**			
	gold	1 ppm			
	Cutoff:	**NA**			
	Category:	**Indicated and inferred mineral resource**			
	Tonnage:	**182000 t**			
	gold	1,45 ppm			
	Cutoff:	**NA**			

Previous calculations

Type:	Company:	Year:	Date:	Calc Method:	Reference:
Resource	Geological Survey of Finland	2001	NA	NA	15
	Comments: Two main lodes or lode sets, Kuivisto E and Kuivisto W.				
	Category:	**Inferred mineral resource**			
	Tonnage:	**0,1 Mt**			
	gold	4 ppm			
	Cutoff:	**NA**			
	Comments: Estimate done only for the Kuivisto E lode				

MINING

Kuivisto

Easting EUREF: 712142,363
Northing EUREF: 6996344,213
Status: Under development
Comments: EIA programme of Karjala Gold Line, including the Rämepuro, Hosko, Kuivisto, Muurinsuo and Kuittila deposits, was announced 8.9.2011.
References: 16

GEOLOGY

Host rock: Intermediate tuff, Komatiite, Porphyry

Intermediate tuff (Host rock)

Rock type: Host rock
Proportion: major
Grain size: NA
Color: NA
References: 9, 11, 12, 14, 17
Comments: The lodes are defined by feldspar- and tourmaline-bearing quartz vein networks in intermediate metatuffite, close to the NNW-trending Pampalo shear zone. Auriferous, quartz-feldspar-tourmaline veins which form the breccia matrix

Ore minerals:

Mineral	Proportion	Mineral texture
Arsenopyrite	minor	
Pyrite	major	
Pyrrhotite	major	

Other minerals:

Mineral	Proportion	Mineral texture
K-Feldspar	present	
Quartz	present	
Scheelite	present	
Tourmaline	present	

Structures
Folded

Alteration:	Distribution:	Degree:	Relation to mineralization:
sericitic alteration	Disseminated	Strong	Syn

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	Post		-550
Comments: Progressive regional metamorphism on ca. 2750-2700 Ma, apparently peaked soon after gold mineralisation, at a temperature of about 550±50°C. Thermal peak was synchronous or outlasted deformation. A relatively strong, but unevenly distributed Palaeoproterozoic overprint.					

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Neoarchean (2800-2500 Ma)	2726-2754		N

Komatiite (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: NA
References: 9, 11, 14, 17
Comments: All lithological units show complicated folding.

Structures
Folded

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)
Regional	amphibolite metamorphic facies	medium metamorphic grade	Post		-550
Comments: Progressive regional metamorphism on ca. 2750-2700 Ma, apparently peaked soon after gold mineralisation, at a temperature of about 550±50°C. Thermal peak was synchronous or outlasted deformation. A relatively strong, but unevenly distributed Palaeoproterozoic overprint.					

Geological age:

Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:		
Neoarchean (2800-2500 Ma)	2708-2708	2708	N		
Comments: Mineralisation either pre-peak metamorphic and formed under greenschist-facies conditions, or syn-peak metamorphic.					
Radiometric age:	**Method:**	**Age:**	**Error (Ma):**	**Mineral:**	**Reference:**
	U-Pb	2708		Titanite	14

Porphyry (Host rock)

Rock type: Host rock
Proportion: minor
Grain size: NA
Color: NA
References: 9, 10, 11, 14, 17
Comments: All lithological units show complicated folding.

Structures
Folded
Comments: The deposit is in the NNW-trending Pampalo Shear Zone system

Textures
Porphyritic

Metamorphic description:

Type:	Facies:	Degree:	Relation to mineralization:	Min P- Max P (kbar)	MIn T- Max T (°C)

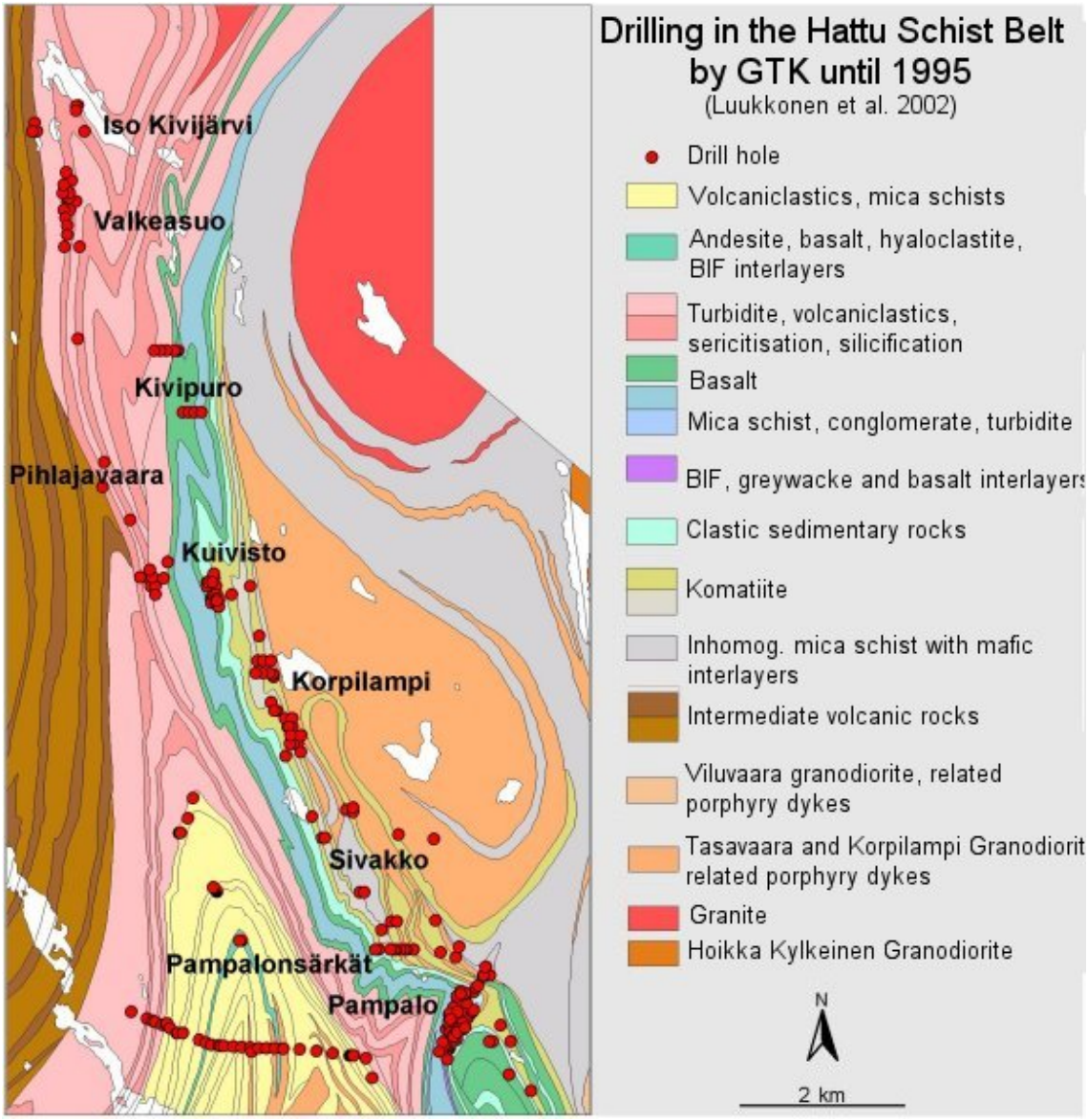
Regional	amphibolite metamorphic facies	medium metamorphic grade	Post	-550
Comments: Progressive regional metamorphism in ca. 2750-2700 Ma, apparently peaked soon after gold mineralisation, at a temperature of about 550±50°C. Thermal peak was synchronous or outlasted deformation. A relatively strong, but unevenly distributed Palaeoproterozoic overprint. Hölttä e al. (2017): Regional metamorphism from 480-500C, 2-4 kbar to 560-570C, 6-7 kbar in the northernmost part of the Hattu belt; regional metamorphic timing: monazite gives 2664 Ma, 2620 Ma + late overprint at 1837 Ma				

Geological age:

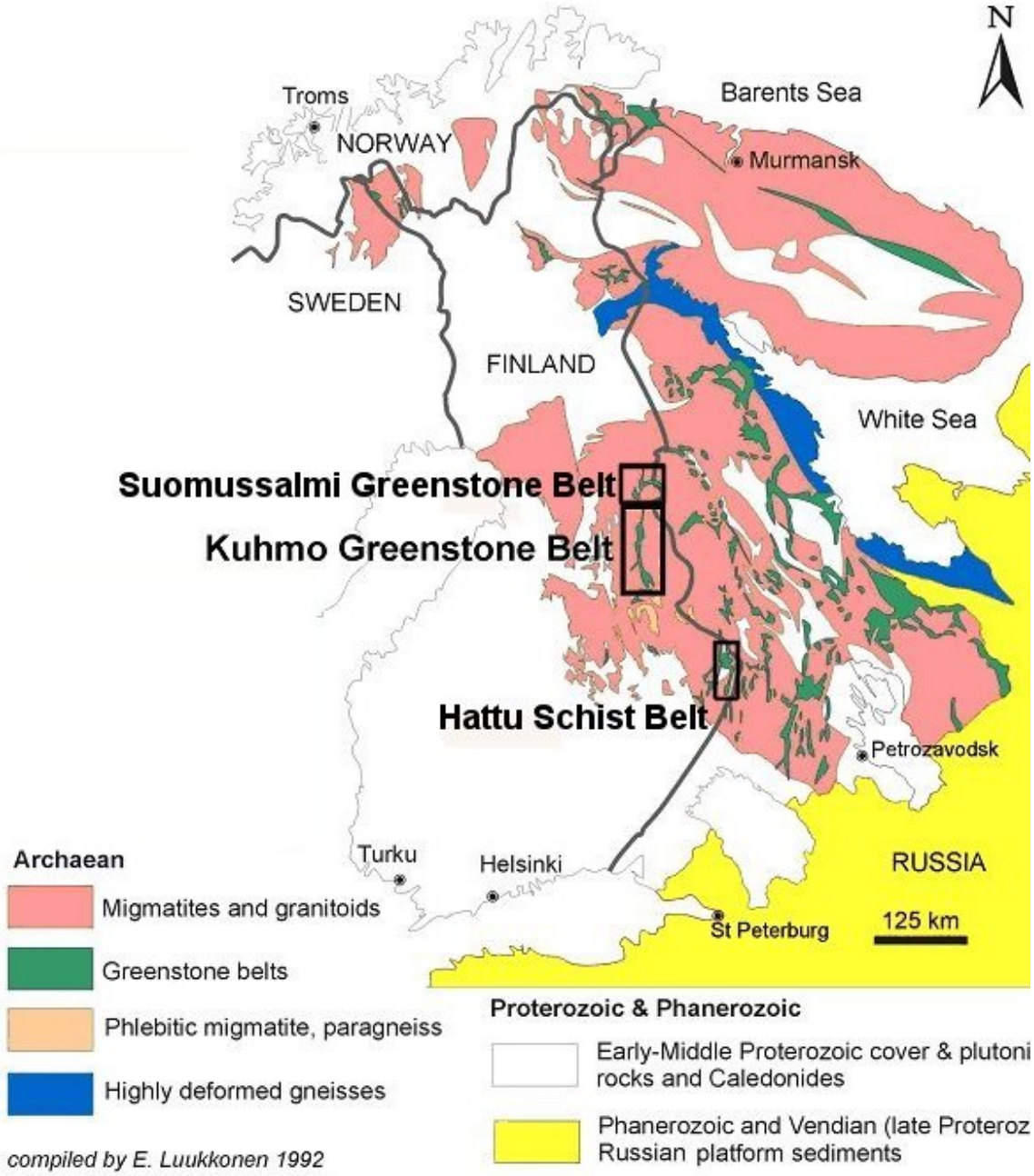
Geological era:	Max age - Minage (Ma):	Inferred age (Ma):	Age of mineralization:
Neoarchean (2800-2500 Ma)	2726-2754		N

Figures

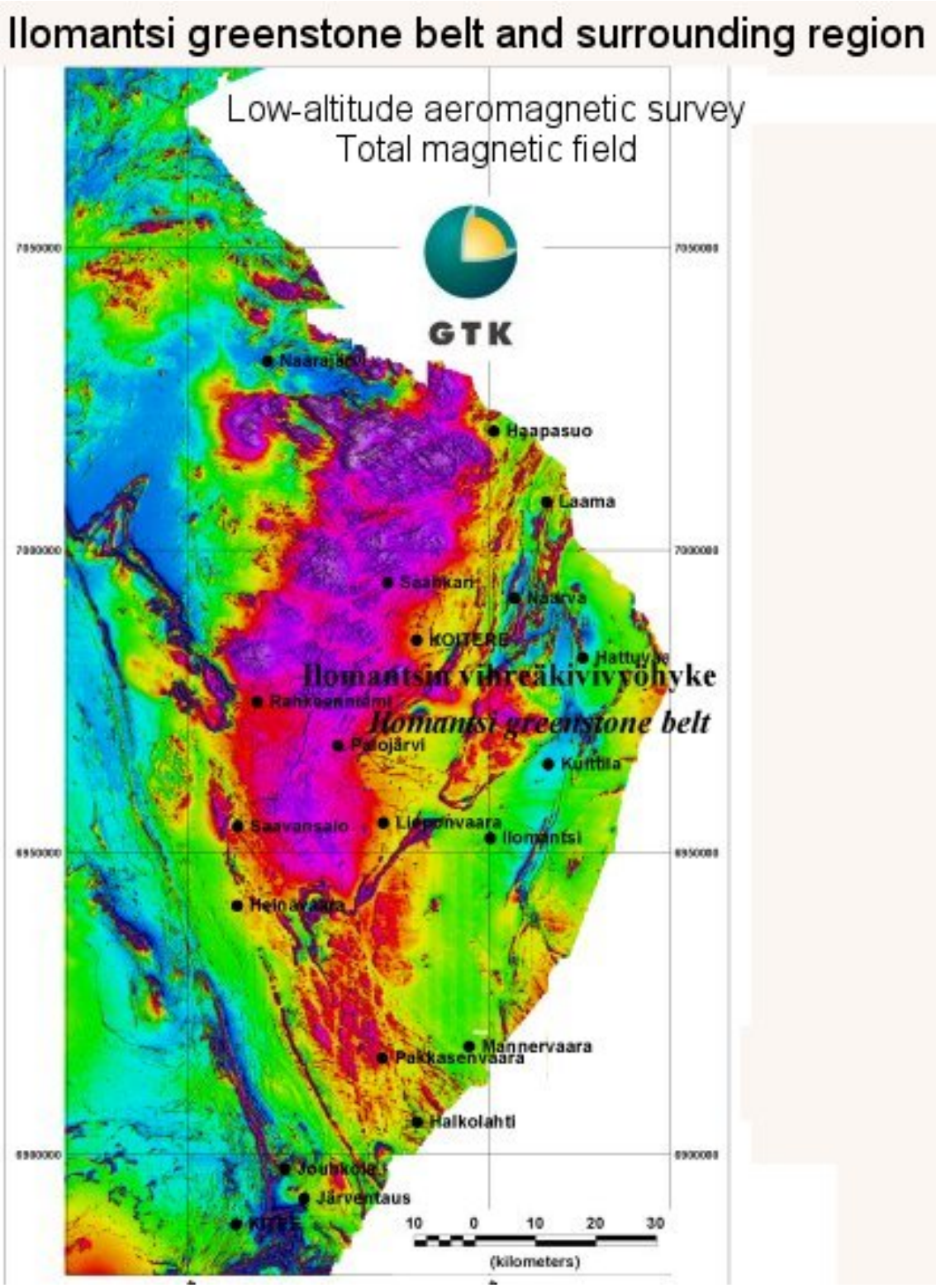
Regional geology, drilling until 1995:



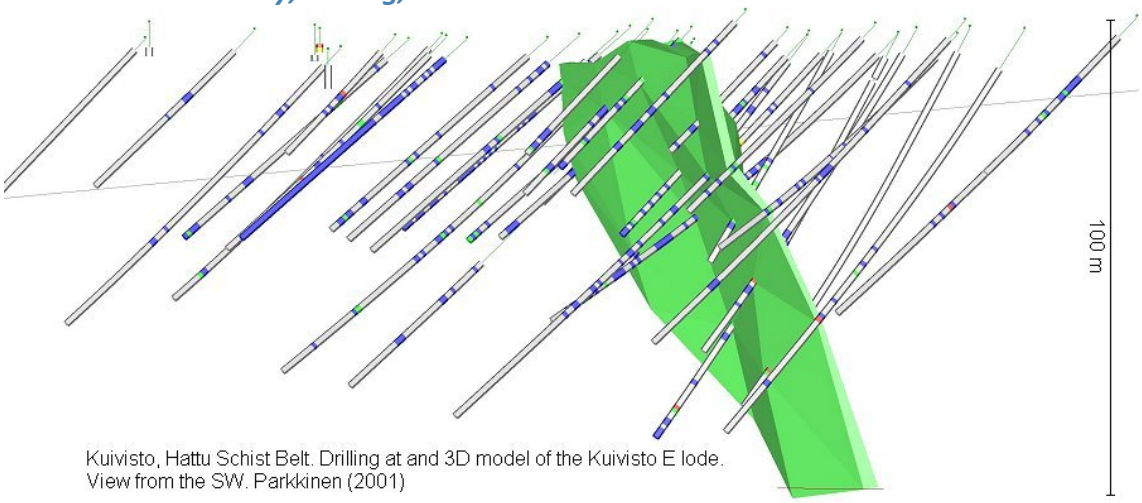
Location in the Carelian craton:



Regional low-altitude airborne magnetic image:

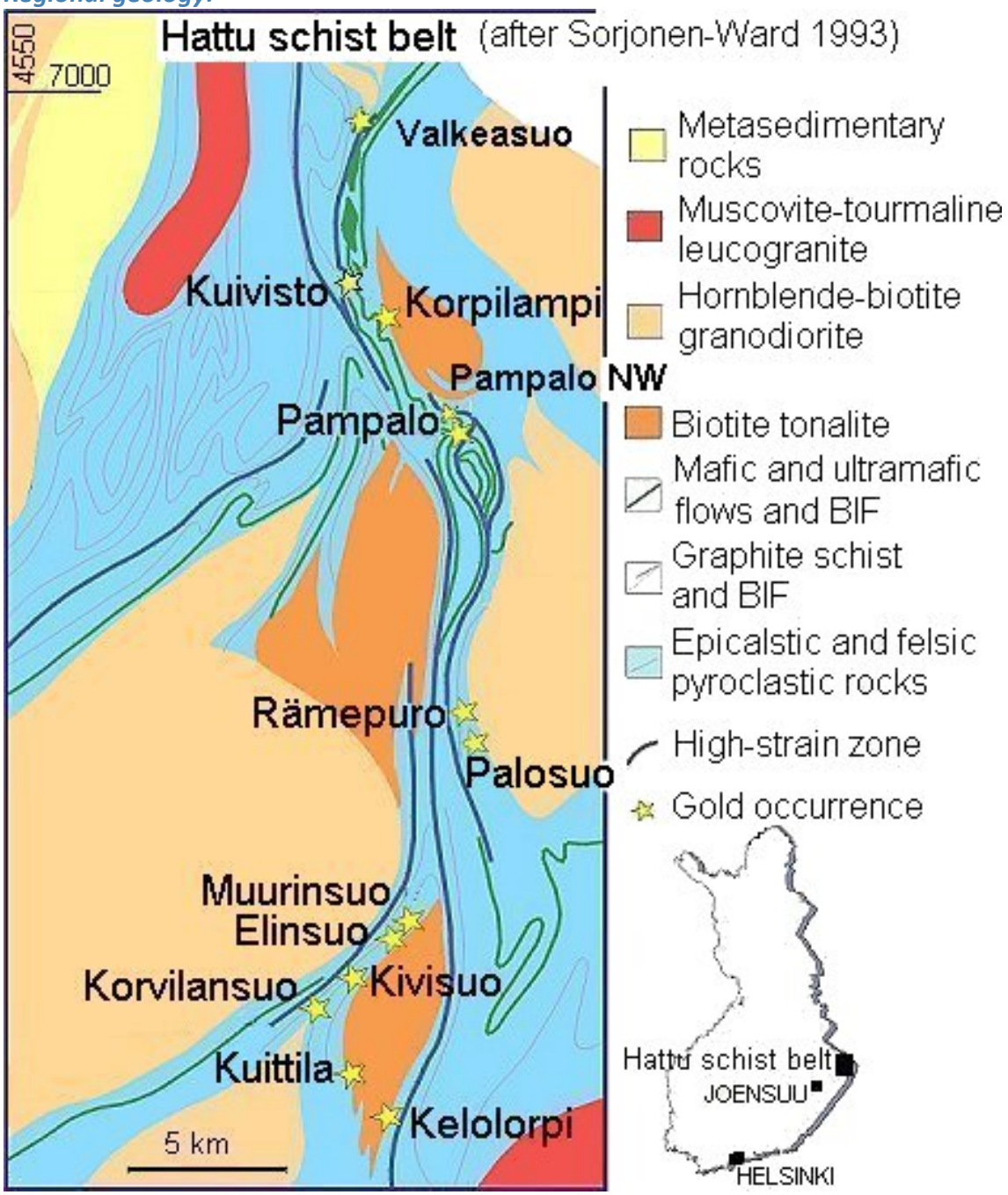


3D model or ore body, drilling, 2001:



Kuivisto, Hattu Schist Belt. Drilling at and 3D model of the Kuivisto E lode.
View from the SW. Parkkinen (2001)

Regional geology:



REFERENCES

1. Endomines 2008. Assay results of the drilling campaign in Kuivisto East during 2007-2008. Appendix to media release of 16 June 2008.
http://tupa.gtk.fi/karttasovellus/mdae/references/341_Kuivisto/341_Endomines018c_160608.pdf

2. Endomines 2008. Press release 16 June 2008.
http://tupa.gtk.fi/karttasovellus/mdae/references/286_Kuittila/286_Endomines018_160608.pdf

3. Endomines 2021. Endominesin malmivara- ja mineraalivarantoarvioiden päivitys. 7.4.2021
http://tupa.gtk.fi/karttasovellus/mdae/references/284_Pampalo/284_Endomines_2021_04_07.pdf

4. Endomines 2022. Endomines reports significant incrase in gold reserves at Pampalo
http://tupa.gtk.fi/karttasovellus/mdae/references/284_Pampalo/284_Endomines_20220331.pdf

5. Endomines 2023. Endomines reports 60 per cent increase in gold reserves at Pampalo
http://tupa.gtk.fi/karttasovellus/mdae/references/284_Pampalo/284_Endomines_20230303.pdf

6. Endomines AB 2014. Press release 2 April 2014
http://tupa.gtk.fi/karttasovellus/mdae/references/284_Pampalo/284_Endomines_2014_04_02_Res.pdf

7. Endomines Oy. 1999. www.endomines.fi on 09/12/99.

8. Hartikainen, A. & Niskanen, M. 2001. Maaperägeokemialliset kultatutkimukset Hatun liuskejaksolla Ilomantsissa vv. 1983-1995. Geological Survey of Finland, Report S/41/4244/1/2001. 22 p.
http://tupa.gtk.fi/raportti/arkisto/S41_4244_1_2001.pdf

9. Heino, T., Hartikainen, A., Koistinen, E. & Niskanen, M. 1995. Tutkimustyöselostus Ilomantsin kunnassa valtausalueilla Sivakko 1 (5188/1), Korpilampi 1-2 (5402/1-2), Korpi 1-4 (5356/1-4), Kuivisto 1 (5210/1), Kuivisto 2-3 (5356/5-6), Pihlajavaara 1-2 (5511/2-3) ja Valkeasuo 1-2 (4853/1, 5511/1) suoritetuista kultamalmitutkimuksista vuosina 1992-1995 sekä neljältä vireillä olevalta valtaukselta (Sivakko 2-3 ja Valkeasuo 3-4). English summary: Report on exploration in Ilomantsi in 1992-1995, within claims Sivakko 1 (Mine Register no. 5188/1), Korpilampi 1-2 (5402/1-2), Korpi 1-4 (5356/1-4), Kuivisto 1 (5210/1), Kuivisto 2-3 (5356/5-6), Pihlajavaara 1-2 (5511/2-3) and Valkeasuo 1-2 (4853/1, 5511/1). Geological Survey of Finland, Report M06/4333/-95/1/10. 17 p.
http://tupa.gtk.fi/raportti/arkisto/m06_4333_95_1_10.pdf

10. Hölttä, P., Lehtonen, E., Lahaye, Y. & Sorjonen-Ward, P. 2017. Metamorphic evolution of the Ilomantsi greenstone belt in the Archaean Karelia province, eastern Finland. Geol. Soc. London, Spec. Publ. 449, 231-250.

11. Korsman, K. (ed.) & Glebovitsky, V. (ed.) 1999. Raahe-Ladoga Zone structure-lithology, metamorphism and metallogeny: a Finnish-Russian cooperation project 1996-1999. Map 2: Metamorphism of the Raahe-Ladoga Zone 1:1000000. Geological Survey of Finland.

12. Liikanen, J. 1999. Ilomantsin Hattuvaaran liuskejakso: Hoskon kultamalmi kooste. Written communication. 3 p.

13. Maptek 2009. Kuivisto East deposit (Finland) mineral resorces report. Maptek KRJA Systems Limited, July 2009.
Edinburgh. 31 p.

http://tupa.gtk.fi/karttasovellus/mdae/references/341_Kuivisto/341_Kuivistoeast_resourcereportjune2009.pdf

14. Nurmi, P. A. & Sorjonen-Ward, P. (eds) 1993. Geological Development, Gold Mineralization and Exploration Methods in the Late Archaean Hattu Schist Belt, Ilomantsi, Eastern Finland. Geological Survey of Finland, Special Paper 17. 386 p.*http://tupa.gtk.fi/julkaisu/specialpaper/sp_017.pdf*

15. Parkkinen, J. 2001. Quality control of mineral resource estimates: Laivakangas, Hosko, Kuivisto E, Other, Osikonmäki, Pirilä, Housuvaara, Pahkalampi. Geological Survey of Finland, Upadate to GTK Report C/M19/2441/2000/1. 27 p.*http://tupa.gtk.fi/raportti/arkisto/25_2020.pdf*

16. Pohjois-Karjalan ELY 2011. Kuulutus. Karjalan kultalinjan kaivoshankkeet *http://tupa.gtk.fi/karttasovellus/mdae/references/291_Hosko/291_KUULUTUSKultalinjaarvohj2011.pdf*

17. Sorjonen-Ward, P. & Luukkonen, E.J. 2005. Archean rocks. In: Precambrian Geology of Finland - Key to the Evolution of The Fennoscandian Shield. Elsevier Science B.V., Amsterdam, 19-99.